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ABSTRACT

A longitudinal comparative study was made of the physical growth and development of Australian fourth-grade students from low, medium, and high socioeconomic groups. Specific questions addressed were (1) Do children differing in socioeconomic status differ in anthropometric characteristics and incidence of physical defects? (2) What is the incidence of physical defects among 9-year-olds, and is the incidence of physical defects associated with lower school achievement? (3) Are differences in school achievement levels and IQ related to anthropometric differences? and, (4) Have the stature and weight of 9- and 10-year-olds increased since 1970? Findings indicated that physical defects were no greater within an economically disadvantaged group than in a more advantaged group. Defects were not found to be associated with lower levels of school achievement. However, significant differences were found in the mean height, weight, and head circumference of disadvantaged and advantaged children. Mean height for both males and females increased over the period between 1970 and 1982-83. Findings supported the claim that height and educational achievement are positively related within each socioeconomic group. (Appended are the medical record form used and other related materials, including a screening test for speech and language, speech therapy data, and a staff conference paper describing the Mt. Druitt longitudinal study and reporting results of the 1982 survey of fourth-graders' physical development and health.) (RH)

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MT. DRUITT LONGITUDINAL STUDY

SCHOOL OF EDUCATION MACQUARIE UNIVERSITY, NORTH RYDE, AUSTRALIA 2113

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REPORT ON LONGITUDINAL STUDY OF GROWTH AND DEVELOPMENT 1982, 1983

ANNE CLARK and PETER O'BRIEN

A Longitudinal Study of
Child Growth and Development and the Incidence of Physical Defects
at ages 9 and 10.

A progress report to the Bernard van Leer Foundation
on the Growth and Development Study
of the Mt Druitt Longitudinal Study
July 1983

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Introduction

Relationships between indices of physical growth (themselves indices of nutritional status and general well being) and factors such as socio-economic status, developmental measures such as intelligence, and school achievement measures have been reported consistently since the beginning of this century. Abernethy (1936) concluded that 'despite differences in criteria, techniques and methods of analysis, the general trend of results indicates that the mental and physical measurements of children are, to some extent, positively related'. Whipple (1914) had suggested that the relationship between physical and mental measurements was largely a question of relative maturity, that is, the relationship should weaken with increasing age and disappear altogether in the adult population, but Shuttleworth's (1939) detailed study of the relationship between mental growth and the age at maximum growth rate (age at maximum growth rate being the most accurate indicator of relative maturity) found no greater relationship than between the actual measurements of physical and mental growth. He did, however, find that the relationship decreased with increasing age.

More recent investigations have reported the same basic findings and sophisticated multivariate techniques are being used to further explore the relationships. Eight co-ordinated international studies (London, Paris, Stockholm, Zurich, Brussels, Dakar and Kampala) linked through the International Children's Centre, Paris, have been collecting data on all aspects of child development since 1955. A special issue of Courrier (30,1980), dedicated to the XVI International Congress of Paediatrics, Barcelona, reports on these studies up to that time. Although the data exist, the relationships of psychological factors and states to somatic growth remain unreported.

Birkbeck, Guthrie and Herbert (1980) report positive univariate relationships between anthropometric and school achievement measures for their Dunedin (New Zealand) Multidisciplinary Child Development Study (data on approximately 900 children from birth to 10 years of age and still being collected) but, once again, the multivariate analyses are incomplete and yet to be reported.

Similar data are not yet available for a large sample of contemporary Australian children. Cross-sectional anthropometric data for Australian children have been published by State Health Departments (eg Jones, Hemphill and Meyers 1973) but growth velocity and the relationship between anthropometric measures and other aspects of development have not been reported. The National Health and Medical Research Council of Australia is currently investigating the exact extent of existing anthropometric data for the Australian population with a view to identifying and perhaps remedying any gaps.

A thorough review of the relevant literature will not be attempted here. The volume of entries in Index Medicus every month is indicative of the immense universal interest currently being sustained by child growth and development and the factors which influence it. Research is being reported from many different countries; Moyes (1976) in St Helena; Karlberg, Taranger, Engstrom, Karlberg, Landsterom, Lichtenstein, Lindstrom and Svennberg-Redegren (1976) in Scandanivia; Buzina (1976) in Yugoslavia; Johnston, Wainer and Thissen et al (1976) in Guatemala; Motajova, (1976) in Czechoslovakia; Mularczyk-Bal (1975) in Poland; Khamaganova and Uvarova (1981) in Russia; Banik (1982) in India; and, Spurr, Reina and Barac-Niets (1983) in Columbia, to list but a few. The titles of studies indicate great concern about the relative influence of genetic and environmental factors. Specifically, many studies have investigated growth rates in contrasting socioeconomic groups (Baertl, Adrianzen and Graham, 1976; Johnston et al, 1976; Christiansen, 1975; Rona, 1981; Panto, 1982; Banik, 1982).

Relationships between socio-economic status and anthropometric measures have also been reported in Australia. Jones et al, (1973) included a sample of Child Welfare Department charges in residential care, as representatives of "underprivileged" children to compare with their main norming sample. They found the underprivileged group to be shorter at all ages than the main Sydney sample. Hitchcock and Gracey (1980) in a study of diet and nutrient intake in relation to socio-economic status in Western Australian children found that boys but not girls in their

higher socio-economic status group were significantly taller than those in the lower socio-economic status group. They did not, however, find any differences between the two groups in either the quantity or quality of the foods eaten, but suggested that their sample did not include any children from families with incomes at or below the poverty line.

A detailed survey by Stuckey and Darnton-Hill (1980) of the dietary intakes of a randomly selected subsample of the Mt Druitt Early Childhood Project Sample (Braithwaite, 1983) found that at five years of age most intakes were above the NHMRC Recommended Daily Allowances, particularly with respect to energy. They expressed concern, however, that one third of the children appeared to have low intakes of at least one nutrient. The dearth of Australian information precludes comparison of these findings with those for other contrast groups in the community, or indeed with the non-Mt Druitt Contrast Schools in the present study. Available information would suggest that few, if any of the children in the present study are actually undernourished; isolated instances of children without lunches have alerted teachers to the possibility that a small number may be.

Pollitt, Mueller and Leibel (1982) suggested that in undernourished populations height is more dependent on socioeconomic status and less on expression of genetic potential than is the case in well-nourished populations. Tanner (1969, 1978) concluded that in the school-age period height and physiological maturity are positively related to measures of intelligence and school achievement even after controlling for socioeconomic status.

Increases during the twentieth century in the mean height and weight of adult populations and of groups of children of specified ages have generally been attributed to improved standards of living and of nutrition in particular. Whether such explanations can be extended to cover observed differences in the anthropometric characteristics for subgroups of a given population remains uncertain. Differential rates of growth, irrespective of gains in absolute terms, need to be considered when interpreting differences observed in groups of children. The possibility that rates of physical and mental growth are related cannot be dismissed and provides the rationale for an educational research project including a study of physical growth.

The aims of this Growth and Development study are to obtain longitudinal data on the physical growth and development of, and the incidence of defects in a group of Australian children and to examine the relationships between these data and a range of other developmental and educational factors. A recent Tasmanian Education Department investigation, for example, claimed that 70 per cent of the children studied had at least one minor physical impairment and that in many cases this could affect progress in school.

The specific questions addressed by this study are:

* do groups of children from different socio-economic backgrounds differ significantly in terms of their anthropometric measurements?
* what are the incidence rates for physical defects in 9 year olds?
* do groups of children from different socio-economic backgrounds differ significantly in terms of the incidence of physical defects (visual, auditory, orthopaedic, congenital, neurological)?
* are the observed differences in school achievement levels and IQ related in any way to differences in anthropometric measurements?
* is the incidence of physical defects associated with lowered school achievement levels?
* has there been a further increase in the stature and weight of nine and ten year old Australians since the currently used Australian normative data was collected in 1970?

This study forms part of the Mt Druitt Longitudinal Study (MDLS) which was attempting to delineate how "disadvantage" functioned for Australian children. Included in the MDLS sample were children, for example, from relative poverty or from single parent families or of Aboriginal descent or of migrant backgrounds, as well as children from advantaged circumstances. Identification of any relationships with academic performance or affective development of any other characteristics of the children, or their families was of importance if children's academic and personal growth were to be maximised.

Method

The MDLS sample comprises some 900 children who are now aged between ten and eleven years of age. A subset of these children were part of the sample of the Mt Druitt Early Childhood Project (MDECP) in their preschool year in 1977. A further subset became part of the MDECP in 1978 (when they enrolled in Kindergarten) as a control group who had not attended a preschool. The remainder joined the MDLS sample in 1981 (in Year 3 of their schooling) when all Year 3 children in the five Mt Druitt area schools having MDECP subjects, and all Year 3 children in three other Sydney schools (selected on the basis of the geographical and socio economic characteristics of their feeder zones which contrasted sharply with the Mt Druitt area) were included in the study (see Table 1).

The New South Wales Health Commission is represented on the MDLS Steering Committee by an officer from its Western Metropolitan Region. The anthropometric data reported here were obtained as part of a co-operative undertaking by the Macquarie University MDLS team and staff of the New South Wales Health Commission's Western Metropolitan Region (Sydney) made available for the duration of the data collection. The other aspect of the joint undertaking was a thorough health screening. The MDLS sample in one Contrast School and five Mt Druitt Schools, all located within the Health Commission's Western Metropolitan region was examined by a team of nurses and doctors during February and March 1982. The findings of the screening component have already been reported at a Health Commission Conference (Haskard, Belfer and Rosley 1983) and all defects identified by the screening have been followed up. This document reports the basic anthropometric findings, the incidence of defects, and the relationships between the anthropometric measures and defects on the one hand, and background factors such as socio-economic status, developmental measures such as intelligence and school achievement measures such as Maths and Reading, on the other.

The Sample

The majority of the MDLS sample in each of the five Mt Druitt area schools and Contrast School 1 were measured and assessed in March/April 1982 and measured again in March/April 1983. Children at Contrast Schools 2 and 3 were measured in March/April 1983 only. Contrasts 1 and 2 are in much higher socio-economic status areas than Mt Druitt, with Contrast 3 falling between Mt Druitt and Contrasts 1 and 2. They also differ in geographical location (see Table 1). Achievement and IQ were assessed at each School during 1982.

Table 1: Characteristics of Sample Schools' Catchment Areas

School	Socio-Economic Status	Geographic Location
Mt Druitt	Low	Outer City/Semi Rural
Contrast 1	High	Outer City/Semi Rural
Contrast 2	High	Inner City
Contrast 3	Medium	Inner City

In any grade cohort, a proportion of the children are outside the age range expected for that grade either because they did not enrol at school as soon as they were legally entitled to or because they have repeated a grade at some stage. Only those children with ages falling within the expected twelve month range (8 years 8 months to 9 years 8 months as at 31.7 82) were included in the sample as shown in Table 2.

Table 2: Numbers in each sample group

Grade	$\bar{X}$ Age in years	Group				
		Sex	Mt Druitt Area (5 Schools)	Contrast Schools 1	2	3
4	9.25	M	191	30	-	-
		F	199	39	-	-
5	10.25	M	120	29	30	17
		F	138	30	32	22

The Measures

1. Anthropometric Measures:

   a) Stature: All heights were measured to the nearest millimetre (by the same person using the one instrument, a Seca stadiometer).

   b) Weight: All weights were measured to the nearest 0.1 kg (by the same person using the one instrument, a Seca beam balance).
   Children removed all heavy items of clothing before being weighed.

   c) Occipito Frontal Circumference:

   A flexible fibreglass tape was placed around the head touching the occipital protruberance at the back and a point on the forehead approximately 2 cms above the supra-orbital ridge, commencing at the 10 cm mark on the tape and subtracting 10 cm from the reading.

   d) Left Upper Arm Circumference:

   A flexible fibreglass tape was placed around the upper arm at a point halfway between the olecranon and the acromion, commencing at the 10 cm mark and subtracting 10 cm from the reading.

   e) External male genitalia in boys and breast development in girls were assessed using the photographs and descriptions for Tanner's Scale (Forfar and Arneill, 1973) giving a 'score' from 1 to 5.

   f) Pubic Hair growth in boys and girls was assessed using photographs and descriptions for Tanner's 5 point scale.

2. Socio-Economic Index:

Father's education, measured on a nine point scale from '9', primary education only through to '1', postgraduate university education, correlating with mother's education (.5 for Mt Druitt and .7 for Contrast School 1) and father's occupation measured on a 16 point scale from '1', high status to '16' low status (correlating .4 for Mt Druitt and .5 for Contrast School 1) was selected to represent socio-economic status.

3. School Achievement Measures:

   a) Word Knowledge — ACER Level B form R
   b) Comprehension — ACER Level B Form R
   c) Mathematics — Mt Druitt Longitudinal Study Measure

4. Intellectual Development Measure:

IQ was measured using the TOLA 4 at all Schools except for one of the Mt Druitt Schools which used the Primary Mental Abilities test.

5. Physical Defects: (Full description of assessment procedures and definitions included in Appendix B).

a) Vision
b) Hearing
c) Blood pressure
d) Orthopaedic defects
e) Congenital defects
f) Neurological defects
g) Speech defects

The Community Nurse at each of the six schools was responsible for head and arm measurements, and vision and hearing assessment.

Four medical practitioners provided by the Western Metropolitan Region of the N.S.W. Health Commission were responsible for measures of sexual development, speech defects, blood pressure, orthopaedic, congenital and neurological defects.

School Counsellors provided the IQ scores from their routine Grade 4 testing program.

Stature, weight and school achievement measurements were carried out by MDLS research assistants.

Data Analysis

Anthropometric measures taken on two occasions twelve months apart for two groups and on a single occasion only for two other groups are reported as means and standard deviations for each group for each occasion for males and females separately. Mean ages for each group are reported.

Differences between groups and sexes were tested for significance by multivariate analysis of variance. Height and weight velocities in cms/yr and kg/yr respectively were calculated for each child and mean velocities reported for each group. Univariate correlations amongst the anthropometric measures are reported for two ages.

Descriptive statistics are provided for sexual development measures and for all health screening variables. Mean achievement levels for groups of children with a particular defect are compared with the relevant overall group means.

Relationships between achievement levels and stage of sexual development could not be investigated adequately due to the small number of cases at the more mature levels of development.

Multivariate regression was used to examine the relationships between anthropometric measures, father's education, age, school achievement and IQ.

The anthropometric statistics are compared with Australian norms based on data collected in 1970.

Results

1. Anthropometric Measures

Table 3: Stature (Height) in mm

	$\bar{X}$ Age in Years		Total Sample	Mt Druitt	Contrast 1	Contrast 2	Contrast 3
Males	9.25	$\bar{X}$	1356	1354	1371		
		n	204	175	29		
		sd	59	58	60		
	10.25	$\bar{X}$	1432	1423	1438	1464	1430
		n	196	120	29	30	17
		sd	63	60	63	61	71
Females	9.25	$\bar{X}$	1348	1341	1379		
		n	226	188	38		
		sd	62	60	62		
	10.25	$\bar{X}$	1429	1415	1447	1462	1449
		n	222	138	30	32	22
		sd	66	66	64	55	54

Table 4: Weight in Kg

	$\bar{X}$ Age in Years		Total Sample	Mt Druitt	Contrast 1	Contrast 2	Contrast 3
Males	9.25	$\bar{X}$	30.1	29.9	30.8		
		n	203	175	28		
		sd	5.3	5.3	5.2		
	10.25	$\bar{X}$	34.2	33.3	34.7	36.6	35.8
		n	196	120	29	30	17
		sd	6.7	6.1	5.7	7.9	9.2
Females	9.25	$\bar{X}$	29.9	29.5	31.7		
		n	224	186	38		
		sd	5.9	5.7	6.3		
	10.25	$\bar{X}$	34.0	32.6	35.0	34.8	39.9
		n	222	138	30	32	22
		sd	6.9	6.5	6.5	5.4	8.1

Table 5: Left mid-upper arm circumference in mm

	$\bar{X}$ Age in Years		Total Sample	Mt Druitt	Contrast 1	Contrast 2	Contrast 3
Males	9.25	$\bar{X}$	201	201	200		
		n	220	190	30		
		sd	21	21	21		
	10.25	$\bar{X}$	208	207	204	211	210
		n	196	120	29	30	17
		sd	22	23	18	23	24
Females	9.25	$\bar{X}$	208	207	213		
		n	236	198	38		
		sd	27	26	30		
	10.25	$\bar{X}$	209	206	212	208	221
		n	222	138	30	32	22
		sd	21	20	22	16	26

Table 6: Occipito frontal (Head) Circumference in mm

	$\bar{X}$ Age in Years		Total Sample	Mt Druitt	Contrast 1	Contrast 2	Contrast 3
Males	9.25	$\bar{X}$	534	533	539		
		n	220	190	30		
		sd	15	15	13		
	10.25	$\bar{X}$	538	537	540	544	538
		n	196	120	29	30	17
		sd	15	15	12	15	21
Females	9.25	$\bar{X}$	524	522	533		
		n	236	198	38		
		sd	16	15	16		
	10.25	$\bar{X}$	531	527	534	541	537
		n	222	138	30	32	22
		sd	16	17	15	12	13

Table 7: Age in days as at 31.7.82

	Mt Druitt	Contrast 1	Contrast 2	Contrast 3
Males				
Mean	3503	3482	3512	3476
Standard Dev.	94	116	80	86
N	191	30	30	17
Females				
Mean	3495	3486	3472	3520
Standard Dev.	102	103	99	98
N	199	39	32	22
Total				
Mean	3499	3484	3492	3501
Standard Dev.	98	108	92	94
N	390	69	62	39

Table 8: Height and Weight Velocity across 12 month period from mean age 9.25 years to mean age 10.25 years

		Mt Druitt			Contrast 1		
		X	n	sd	X	n	sd
Height (cm)							
	Males	6.6	106	1.0	6.5	27	1.0
	Females	7.2	129	1.6	7.4	29	1.1
	Total	6.9	235	1.4	6.9	56	1.2
Weight (kgs)							
	Males	3.5	106	2.3	3.1	26	1.1
	Females	3.6	128	2.2	3.8	29	1.6
	Total	3.6	234	2.2	3.4	55	1.4

Table 9: Univariate correlations between height, weight, head circumference and left upper arm circumference at mean age 9.25 years

	Height	Weight	Head Circum.	U. Left Arm
Height	1.0	.7	.5	.5
Weight	.7	1.0	.6	.8
Head Circumference	.5	.4	1.0	.5
Upper Left Arm	.4	.7	.3	1.0

Lower triangle - Mt Druitt
Upper triangle - Contrast 1

Table 10: Univariate Correlations between height, weight, head circumference and left upper arm circumference at mean age 10.25 years

	Height	Weight	Head Circum.	U. Left Arm
Height	1.0	.7	.4	.5
Weight	.7	1.0	.5	.9
Head Circumference	.5	.5	1.0	.4
Upper Left Arm	.4	.8	.4	1.0

Lower triangle - Mt Druitt
Upper triangle - Contrast 1 and 2

Multivariate Analysis of Variance of Anthropometric Measures

a) At age 9.25 years.

Height, weight, head circumference and upper left arm circumference were analysed by group (Mt Druitt and Contrast 1) and sex while covarying for age. The design was unbalanced (unequal cell frequencies) so the analysis was executed to correct each term for every other term in the model.

As anticipated, age was a significant source of variation in height ($p = .000$) and weight ($p = .038$) confirming the need for its inclusion as a covariate. The group means for age, however, did not differ significantly. There was no significant interaction between group and sex. The contrast group was significantly taller, heavier and had larger head circumferences than the Mt Druitt group. Boys had significantly larger head circumferences than girls while the reverse was true for upper left arm circumference.

Table 11: Multivariate Tests of Significance (Anthropometric measures at 9.25 years)

EFFECT	WILKS	APPROX F	HYPOTH DF	ERROR DF	SIGNIFICANCE OF F
Covariate - Age	.957	4.642	4	416	.001
Main Effect - Group	.945	6.062	4	416	.000
Main Effect - Sex	.916	9.483	4	416	.000
Interaction - Group X Sex	.994	.580	4	416	.677

Table 12: Univariate F tests with (1,419) DF (Anthropometric measures at 9.25 years)

	EFFECTS			
	AGE	GROUP	SEX	GROUP X SEX
Height	13.217**	13.415**	.047	1.689
Weight	4.311*	4.699*	.230	.806
Head	0.290	17.966**	14.802**	1.418
Upper left arm	1.554	.928	8.633**	.744

** $p < .001$

* $p < .05$

b) At age 10.25 years

The multivariate analysis of variance was repeated for the same measures made twelve months later. On this occasion two additional sets of contrast figures were available. Contrast 3 was not included due to the ethnic heterogeneity of the sample, which contained a large number of Greek/Australian children. Jones et al (1973) report that Southern European migrants were on the whole shorter than Australians of at least second generation. (Contrast 1 and Contrast 2 were combined for the purpose of this analysis.)

Table 13: Multivariate tests of significance (Anthropometric measures at 10.25 years)

EFFECT	WILKS	APPROX F	HYPOTH DF	ERROR DF	SIGNIFICANCE OF F
Covariate - Age	.926	7.432	4	374	.000
Main Effect - Group	.898	10.578	4	374	.000
Main Effect - Sex	.929	7.148	4	374	.000
Interaction - Group X Sex	.984	1.541	4	374	.190

Table 14: Univariate F tests with (1,377) DF (Anthropometric measures at 10.25 years)

	EFFECTS			
	AGE	GROUP	SEX	GROUP X SEX
Height	18.917**	28.534**	.052	1.057
Weight	3.584*	12.771**	.712	0.039
Head	.628	22.821**	19.211**	2.975
Upper left arm	1.018	.974	0.082	0.453

** $p < .001$

Once again, the Contrast group was significantly taller, heavier and had larger head circumferences than the Mt Druitt group. Boys had significantly larger head circumferences than girls but the previously observed sex difference in upper left arm circumference had disappeared.

Comparison with Australian Norms

Table 15: Comparison with Australian Anthropometric Norms - Height (cms) and Weight (kgs) (Jones et al, 1973)

		Age last Birthday * in Years (n = 263)			
		9		10	
		MDLS-1982	NSW Health Dept 1970	MDLS-1983	NSW Health Dept 1970
Age	$\bar{X}$	9.42	9.52	10.42	10.50
Height					
Males	$\bar{X}$	136.40	134.48	142.95	139.29
	sd	5.79	6.16	5.97	6.40
Females	$\bar{X}$	135.76	133.48	142.88	138.93
	sd	5.91	6.36	6.45	6.90
Weight					
Males	$\bar{X}$	30.50	30.69	34.05	33.92
	sd	5.55	5.70	6.36	6.75
Females	$\bar{X}$	29.75	30.43	33.39	33.78
	sd	5.19	5.84	6.32	6.81

* Cases were selected to construct a sample matching the norming sample for age. Only cases measured at both ages were included.

Table 16: Comparison with Australian Anthropometric Norms - differences between males and females for height and weight

	Age last birthday			
	8	9	10	11
Height (Males - females) (cms)				
NSW Health Dept 1970	+1.03	+1.00	+0.36	-1.72
MDLS 1982/83	***	+0.64	+0.07	***
Weight (Males-females) (kgs)				
NSW Health Dept 1970	+0.55	+0.26	+0.14	-1.83
MDLS 1982/83	***	+0.75	+0.66	***

*** Not available

The MDLS sample was never intended to be representative of the Australian population and would tend to give underestimates of true measurements due to over-representation of the lower socio-economic groups. The increases in mean height at ages nine and ten between 1970 and 1982/83 can therefore be taken as a conservative estimate of the true increase. The age at onset of the pubescent growth spurt would appear to be decreasing given the age at which the mean female height temporarily overtakes the mean male height (see Table 16) and the amounts by which the MDLS mean heights are greater than the 1970 norms i.e. the difference for age 10 is twice as great as it was for age 9. Given the height velocities shown in Table 8 the increase in height represents approximately 7 to 8 months in age.

Sexual Development

Sexual development was assessed by a team of medical practitioners using Tanner's five point scales for development of male genitalia, female breasts and pubic hair growth.

Only children aged between 8 years 8 months and 9 years 8 months at time of assessment were included in this analysis. The percentage of the group of children in the grade but beyond these age limits i.e. older than the selected sample due to repeating or late starting, who were pre-pubescent was greater than that of the total sample but similar to that of the Mt Druitt Subgroup. Eighty seven percent of the older boys and 78 percent of the older girls were assessed as level 1 on Tanner's Scale of sexual development. It would appear that children who have repeated a grade, presumably because they were not coping with their schoolwork, may also be slow to develop physically.

Table 17: Percentages of males and females in the Mt Druitt and Contrast 1 subgroups at each level of sexual development

SEXUAL DEVELOPMENT (Tanner's Scale)	MALES		FEMALES	
	MT DRUITT n = 189	CONTRAST 1 n = 30	MT DRUITT n = 194	CONTRAST 1 n = 39
1	90.5	23.3	84.5	38.5
2	9.5	53.3	12.4	56.4
3	0	23.3	2.6	5.1
4	0	0	.5	0

The majority of children (97.7% of males, 94.9% of females) were still at level 1 in terms of growth of pubic hair. Only 5 males (all in the Mt Druitt group) and 11 females (a similar proportion coming from each subgroup) were classified as level 2 and one Mt Druitt female was level 3.

One girl had commenced menstruation.

2. Socio-economic Indices

Table 18: Socio-economic status indicators

	Mt Druitt (n = 186)		Contrast 1 (n = 42)	
	$\bar{X}$	sd	$\bar{X}$	sd
Father's Education	6.36	1.04	5.32	1.52
Mother's Education	6.09	1.21	4.55	1.86
Father's Occupation	9.94	3.26	7.06	3.88

Table 19: Interrelationships amongst the Socio-economic Status Indicators

	Father's Educ	Mother's Educ	Father's Occ
Father's Education	1.00	.67	.53
Mother's Education	.47	1.00	.37
Father's Occupation	.36	.24	1.00

Lower triangle - Mt Druitt
Upper triangle - Contrast 1

3. Achievement Measures

Table 20: Achievement Tests at Mean Age 9.25 Years

GROUP		MATHEMATICS			WORD KNOWLEDGE		
		$\bar{X}$	n	sd	$\bar{X}$	n	sd
Mt Druitt	- Males	46.7	180	15.1	19.6	172	8.4
	- Females	49.2	185	14.7	20.7	180	7.8
	- Total	48.0	365	14.9	20.1	352	8.1
Contrast 1	- Males	63.9	26	10.1	30.2	29	6.6
	- Females	65.8	36	9.1	29.8	36	7.4
	- Total	65.0	62	9.5	30.0	65	7.0
Contrast 2	- Males	55.1	16	9.8	31.0	28	6.3
	- Females	60.9	19	8.0	32.7	31	6.3
	- Total	58.3	35	9.2	31.9	59	6.3
Contrast 3	- Males	58.9	16	8.7	25.5	17	7.0
	- Females	49.8	21	16.2	21.5	22	7.4
	- Total	53.7	37	14.1	23.2	39	7.4

4. Intellectual Development

Table 21: Intelligence Quotients at Mean Age 9.25 Years

Group	Mt Druitt			Contrast 1			Contrast 2			Contrast 3		
	$\bar{X}$	n	sd	$\bar{X}$	n	sd	$\bar{X}$	n	sd	$\bar{X}$	n	sd
Males	92.9	142	11.9	112.1	28	11.8	109.2	25	11.0	103.1	16	13.1
Females	93.1	139	12.6	111.9	34	10.9	114.0	26	8.8	98.7	21	10.7
Total	93.0	281	12.2	112.0	62	11.2	111.6	51	10.1	100.6	37	11.9

5. Health Screening - Physical Defects

a) Vision

Glasses were already being used by 5.6% of the children. Australian Bureau of Statistics (1979) reports 3.4% of 5-9 year olds and 6.6% of 10-14 year olds wear glasses. Two children were assessed as having defects which could not be corrected and six children with defective sight were found to be wearing either inadequate glasses or no glasses at all.

All children were tested without glasses. Those with glasses were retested wearing their glasses.

Table 22: Vision without glasses - Percentages
n = 574

Sight	Right Eye	Left Eye
6/6	92.5	92.1
6/9	4.5	5.1
6/12	1.6	1.6
6/18	.9	.9
6/24	.2	.2
6/36	.3	0.0
6/60	0.0	.2

Table 23: Vision with glasses - Percentages
n = 26

Sight	Right Eye	Left Eye
6/6	57.7	38.5
6/9	34.6	38.5
6/12	0.0	19.2
6/18	7.7	3.8

b) Hearing

Each ear was tested for high and low frequency hearing loss. There was a slightly greater percentage suffering low frequency loss than there was for high frequency loss. Percentages for right ear loss were slightly lower than for left ear loss.

Table 24: Percentages suffering hearing losses.
n = 574

Degree of loss	Right Ear		Left Ear	
	High Freq.	Low Freq.	High Freq.	Low Freq.
None	97.2	95.3	96.3	94.6
Mild	1.7	3.1	2.3	3.8
Moderate	.9	1.2	.9	1.0
Severe	.2	.3	.5	.5

At the same time 3.8% were found to have an ear infection.

c) Blood Pressure

Children with systolic blood pressure above 110 mmHg or diastolic pressures below 70 were classified as having a mild disability. Thirteen of the 22 children thus classified were from the same school. Subsequent retesting resulted in normal readings in all but two cases. Due to this lack of reliability of the readings the figures given in Table 25 should be interpreted with caution.

Table 25: Distribution of Blood Pressure Measures

	N	$\overline{X}$	sd	Minimum	Maximum
Systolic	561	95.5	9.7	66	125
Diastolic	561	60.4	7.9	30	85

d) Orthopaedic Defects

Fifty children were assessed as having a mild orthopaedic disability, one moderate and one severe. Although 52 (9.2% of the sample) had defects, 33 (63%) of them did not warrant treatment of any kind. Eleven children (21% of those with a disability, 2% of total sample) were found to be in need of treatment. A further four were already being treated, two had completed treatment and two had conditions not amenable to treatment.

e) Congenital Defects

Seventy children (12.3% of the sample) had mild (59), moderate (7) or severe (4) congenital defects. More than half of these (54%) required no treatment, ten (14%) had already completed treatment, five (7%) were currently being treated, five (7%) could not be treated and 18 (26%) were in need of treatment.

There were no instances of paresis and only two cases of cerebral palsy (.4% of sample).

f) Speech Defects

The several aspects of speech assessed can be broadly classified as the language aspects and the physical aspects of speech production.

Table 26: Percentages of Physcial Defects related to Speech Production

Problem	Total Sample n = 575	Mt Druitt n = 502	Contrast 1 n = 73
Articulation	19.1	20.13	10.9
Oro-muscular	2.4	2.2	4.1
Voice disorder	4.8	4.1	9.6
Fluency	2.1	2.4	0.0

Table 27: Percentages of Language Defects

Problem	Total Sample n = 575	Mt Druitt n = 502	Contrast 1 n =73
Comprehension			
Mild	16.2	18.0	4.1
Significant	6.5	7.5	0.0
Total	22.7	25.5	4.1
Expression			
Mild	16.5	16.9	13.7
Moderate	15.4	16.9	5.5
Severe	3.4	3.3	4.1
Total	35.3	37.1	23.3

The majority of children with physical speech problems had no language problems at all or a mild expressive language problem only.

Table 28: Percentages of Children with Physical Speech Problems But No Language Problems

	Oro-muscular defects	Voice Disorders	Fluency defects
No Comprehension Problem	86	70	58
No Expression Problem	50	56	25
Neither problem	36	44	25

Half of the children with a moderate or severe expressive language problem did not have a comprehension problem but only a quarter of the children described as having a significant comprehension problem had no expressive language problem.

Approximately 8% of the sample (45 children) had physical speech defects, some children having more than one of the listed problems.

Approximately 35% of the sample (200 children) had language defects (comprehension and or expression). The overall assessment indicated that 37% (196 children) were in need of treatment, the majority for language rather than physical problems. Baker's (1982) summary of the speech data for the Health Commission indicates low reliability of the data (Appendix C).

g) Multiple Defects

A small number of children suffer from more than one of the defects listed e.g. one third of the congenitally defective have orthopaedic defects and half of the orthopaedically defective have congenital defects (24 children suffer from both). A few children with hearing loss or physical speech problems have other congenital and/or orthopaedic defects as well.

h) Value of the Health Screening

Quite apart from providing data of academic interest about rates of occurrence of a variety of defects, thirty two children requiring treatment were identified as a result of this screening and are now receiving appropriate treatment. A further 196 have been identified as requiring help with a speech problem and these children will be followed up in due course.

Table 29: Children identified as requiring treatment

Defect	Number Requiring Treatment
Vision	6
Orthopaedic	11
Congenital	18*
Speech	196

* includes 3 children who also require treatment for an orthopaedic defect.

6. Relationships between School Achievement and Physical Development

a) Sexual Development

The relationship between school achievement and level of sexual development could not be examined statistically due to the small numbers in the higher levels of sexual development. Level of sexual development was not entered as a variable in the multivariate regression along with the other anthropometric measures because the data was categorical.

b) Relationships between Physical Defects and School Achievement

The mean achievement scores for Word Knowledge, Comprehension and Maths were calculated for each group of children suffering from a particular defect. In the case of vision only those children with uncorrected or unable to be corrected vision defects were included. The hearing defective group includes those with a moderate or severe hearing loss of upper and/or lower frequencies in either or both ears.

Table 30: Achievement Means for Groups of Children with Specific Physical Defects

GROUP	N	Word Knowledge $\bar{X}$	Word Knowledge sd	Comprehension $\bar{X}$	Comprehension sd	Maths $\bar{X}$	Maths sd
All Mt Druitt Schools and Contrast 1	538	20.58	7.86	18.20	6.86	48.64	15.69
All Mt Druitt Schools	458	19.22	7.96	16.95	7.01	46.37	15.28
Speech Disorders	83	16.89	8.35	15.69	7.49	43.24	16.02
Visually Defective	8	22.75	9.63	18.14	7.97	52.88	10.47
Hearing Impaired	14	18.27	8.19	17.73	8.68	46.08	16.86
Congenital Defects	28	17.54	9.09	16.24	8.40	42.46	16.03
Abnormal Blood Pressure	22	21.80	9.7	18.81	8.51	48.84	17.19
Orthopaedic Defects	14	17.93	7.90	15.38	7.24	42.14	15.43

The speech defects group alone appears to be achieving at lower levels than the total group. All other groups suffering physical defects include children across the full range of achievement levels.

c) School Achievement, IQ, Height, Age and Father's Education

The relationships amongst this set of variables were investigated through multivariate regression analysis using the Statistical Package for the Social Sciences (Hull and Nie, 1981). As there was a large difference between the achievement levels of the Mt Druitt group compared with Contrast School 1 the analysis was performed separately for the Mt Druitt sample as well as for the combined sample (Mt Druitt and Contrast School 1). This method of analysis was used to provide information about the patterns of interdependence between two sets of variables, the number of statistically significant links between the sets and the extent to which the variance in one set is redundant, given the other set. For convenience, one set is referred to as the dependent variables and the other as the independent variables.

The independent variables were height, age and father's education level; interactions between height and age and height and father's occupation were included in the design. The dependent variables were mathematics, word knowledge and IQ Scores. The analysis for Mt Druitt alone produced essentially the same results (with reduced percentages of variance explained) as was obtained for the combined sample thus validating the use of the composite group. Tables summarising the results of the analyses for each group are included in Appendix E.

Four multivariate tests of significance (Pillais, Hotellings, Wilks and Roys) all gave F values significant at the .000 level for both groups (for the combined sample Wilks Lambda = .6865, F = 5.914 (15,608)).

Two linear combinations of each set of variables selected so that the correlation between the corresponding linear combinations from each set would be maximised, were significantly related.

The first linear combination (canonical variable) of the dependent variables (representing 65.7% of the variance in the original variables) could be described as the 'ability component' of achievement and IQ, determined largely by genetic and/or family environmental factors. The second (representing 22.6% of the variance in the original variables) could be described as that component of achievement resulting from schooling effects. The negative relationship between IQ and the first canonical variable in the Mt Druitt analysis is most probably a statistical artefact resulting from the restricted distribution of IQ scores in that sample. The distribution of IQ scores for the combined sample more closely approximates the distribution for the population in general. If the above interpretation of the canonical variables is correct, it would appear that schools have a greater impact on IQ in areas such as Mt Druitt than they can hope to have in more advantaged areas, i.e. IQ for the Mt Druitt group is less closely related to family background characteristics.

These two canonical variables of the dependent variables account for a total of 17.79% of the variance in the independent variables.

The two canonical variables of the independent variables, (representing 32.6% and 39.7% of the variance in the original variables) with height, age and father's education all significantly represented, account for a total of 11.51% of the variance in the dependent variables.

Thus a small but significant part of the variation in IQ and school achievement can be explained in terms of age, height and father's education.

Discussion

The incidence of physical defects, visual, auditory, orthopaedic, congenital and neurological, is no greater within an economically disadvantaged group than it is in a more advantaged group. Nor are such defects associated with lower levels of school achievement. In the absence of normative data for the occurrence of physical defects in Australian children, no assessment can be made of the absolute levels of incidence.

At the individual level the health screening component of this study was well worth the effort. Detected defects have been or are being treated and the statement made by the mother of a girl discovered to be suffering from scoliosis that "early detection and subsequent treatment has prevented my daughter from becoming a cripple for life" clearly illustrates the value of the screening.

The significant differences in the mean height, weight and head circumference of the Mt Druitt children compared with a more advantaged group of children are cause for concern. Given that comparable differences would not be expected in the adult population, such differences must be interpreted as reflecting different rates of development. That physical growth rates are subject to environmental influences in less than optimally nourished populations is well established. The increase in mean height for both males and females at ages nine and ten years over the past twelve years can only be the result of environmental factors. There are strong indications that the observed differences between the two groups do indeed represent differential rates of development. The mean height of the advantaged girls, for example,

surpassed that for advantaged boys sooner than was the case in the disadvantaged group.

The aetiology of the variation in growth rates for these two groups can only be the subject of speculation at this stage. The existence of genetic determinants cannot be ruled out and the evidence for the existence and effect of nutritional and/or emotional differences in advantaged and disadvantaged environments in Australia is yet to be demonstrated. The disadvantaged group could not be described as malnourished in absolute terms but may be relatively less well nourished than the advantaged group. The concurrent differences in IQ and school achievement between the two groups and the explanation of 12% of the variance in such measures by means of relations with height, father's education and age points to parallel differential rates of intellectual development. Optimal physical and mental growth may be associated via the common process of physiological maturation.

A major difficulty in seeking direct relationships between height and other variables is the inability to allow for differences in final mature height, which in part at least is genetically determined and is expected to be normally distributed. It is one thing to compare the mean heights for two groups, assuming the final height variation to be similarly distributed in each group, but quite a different matter to compare an individual's height and say, school achievement. It is not being suggested that 'tall people per se are smarter' but that children relatively closer to their mature height at a given age may also be relatively more intellectually mature than other children of the same age. Inability to covary for final mature height is possibly responsible for the relatively small correlations (usually .2 to .3) obtained between school achievement and height.

The findings of this study do, however, support Tanner's claim that height and educational achievement are positively related within each socioeconomic group. Pollitt et al. (1982) claim that weight-for-height is a more appropriate indicator of advanced physical maturation if the population under investigation is well nourished.

The positive relationship between physical maturation and school achievement was confirmed yet again in Pollitt's well nourished sample, giving credence to the hereditary explanation of differential rates of development.

The existence of differential rates of intellectual development, regardless of whether genetically or environmentally determined, raises serious questions about educational practices which group children according to chronological age. The outcomes of slower rates of development, in the form of lower test scores, serve to accentuate the differences and may through such mechanisms as lowered self esteem, operate to lower the final level of intellectual development attained.

Given that the retardation in rate of physical development of the Mt Druitt group is of sufficient magnitude to produce a mean difference of 2 to 3 cms in height between advantaged and disadvantaged groups by 9 years of age, governments should be concerned about the possibility that environmental factors may be responsible. The provision of physically adequate housing may be insufficient if nutritional and emotional deficiencies claimed to be associated with relative poverty can undermine efforts to provide equal educational opportunities for all children.

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Appendix A

Mt Druitt Longitudinal Study
Medical Record

MT DRUITT LONGITUDINAL STUDY

MEDICAL RECORD

GENERAL

Col 1-5

1 Child's Name: (Please Print) ..... | | | | | |

Col 6-10

2 Date of Birth: ..... | | | | | |

Col 11

3 Gender: Male 1

Female 2

4 VISION Col 12

a) Glasses worn? Yes 1

No 2

b) Without glasses: Col 13

(i) Right Eye 6/6 1

6/9 2

6/12 3

6/18 4

6/24 5

6/36 6

6/60 7

worse than 6/60 8

Col 14

(ii) Left Eye 6/6 1

6/9 2

6/12 3

6/18 4

6/24 5

6/36 6

6/60 7

worse than 6/60 8

(c) With glasses: Col 15

(i) Right Eye 6/6 1

6/9 2

6/12 3

6/18 4

6/24 5

6/36 6

6/60 7

worse than 6/60 8

Col 16

(ii) Left Eye 6/6 1

6/9 2

6/12 3

6/18 4

6/24 5

6/36 6

6/60 7

worse than 6/60 8

Col 17

(d) Impairment of vision: Corrected 1

Unable to be corrected..... 2

Uncorrected 3

5 HEARING

(a) (i) Low frequency: Left Ear Col 18

No low frequency loss 1

Mild low frequency loss 2

Moderate low frequency loss 3

Severe low frequency loss 4

(ii) Low frequency: Right Ear Col 19

No low frequency loss 1

Mild low frequency loss 2

Moderate low frequency loss 3

Severe low frequency loss 4

(b) (i) High frequency: Left Ear Col 20

No high frequency loss 1

Mild high frequency loss 2

Moderate high frequency loss 3

Severe high frequency loss 4

(ii) High frequency: Right Ear Col 21

No high frequency loss 1

Mild high frequency loss 2

Moderate high frequency loss 3

Severe high frequency loss 4

(c) Ear infection: Col 22

Evident 1

Not evident 2

6 HEIGHT Col 23-26

(In centimetres to one decimal place) ..... [| | |]

7 WEIGHT Col 27-30

(In kilograms to one decimal place) ..... [| | |]

8 UPPER ARM CIRCUMFERENCE

(In millimetres) Col 31-33

(i) Right arm ..... [| |]

Col 34-36

(ii) Left arm ..... [| |]

9 HEAD CIRCUMFERENCE Col 37-39

(In centimetres to one decimal place) ..... [| |]

10 *BLOOD PRESSURE* Col 40

Normal 1

Above normal 2

11 ORTHOPAEDIC DEFECTS Col 41

(a) Disability

No disability present 1

Mild disability present 2

Moderate disability present 3

Severe disability present 4

(b) Treatment Col 42

No treatment required 1

Under treatment 2

Treatment completed 3

Requiring treatment 4

Defect present not amenable to treatment 5

12 CONGENITAL DEFECTS: Col 43

(a) Defect

No defect present 1

Mild defect present 2

Moderate defect present 3

Severe defect present 4

(b) Treatment Col 44

No treatment required 1

Under treatment 2

Treatment completed 3

Requiring treatment 4

Defect present not amenable to treatment 5

13 NEUROLOGICAL DEFECTS — Col 45

(a) Paresis

One arm	1
One leg	2
Two arms	3
Two legs	4
Right hemiplegia	5
Left hemiplegia	6

Col 46

(b) Ataxia

Present	1
Absent	2

Col 47

(c) Cerebral Palsy

Present	1
Absent	2

14 SPEECH DEFECTS: — Col 48

(a) Articulation (Sounds of Speech):

Absent	1
Present	2

Col 49

(b) Comprehension (Receptive Language):

	Absent	1
Mild Defect	present	2
Moderate Defect	present	3
Severe Defect	present	4

(c) Expressive Language (grammar, vocabulary): — Col 50

	Absent	1
Mild Defect	present	2
Moderate Defect	present	3
Severe Defect	present	4

(d) Oro-muscular Problems: Col 51

Absent 1

Present 2

(e) Voice Disorders: Col 52

Absent 1

Present 2

(f) Fluency (Stuttering): Col 53

Absent 1

Mild Defect 2

Moderate Defect 3

Severe Defect 4

(g) Speech Defect: Col 54

None Present 1

Under Treatment 2

Treatment Completed 3

Requiring Treatment 4

Defect Present Not Amenable to Treatment 5

15 MALE SEXUAL DEVELOPMENT Col 55

(a) Genitalia (Tanner's five point scale) 1

..... 2

..... 3

..... 4

..... 5

Col 56

(b) Pubic Hair (Tanner's five point scale) 1

..... 2

..... 3

..... 4

..... 5

16 FEMALE SEXUAL DEVELOPMENT Col 57

(a) Breasts (Tanner's five point scale) 1

..... 2

..... 3

..... 4

..... 5

Col 58

(b) Pubic Hair (Tanner's five point scale) 1

..... 2

..... 3

..... 4

..... 5

Col 59

(c) Menarche: Occurred 1

Not yet occurred 2

Appendix B

1. Explanatory Notes for MDLS Medical Record.

2. Screening Test of Speech and Language for the Mt Druitt Early Childhood Project.

3. Stages of development of the secondary sex characteristics.

1. EXPLANATORY NOTES

1. Generalist community nurses will carry out the items 1-9 inclusive but will omit items 6 and 7 (Height and Weight).

2. Medical officers will carry out the items 10-16 inclusive.

3. Hearing testing.

3.1	Low frequencey	-	1000
	High frequency	-	4000
3.2	Mild loss	-	25-45
	Moderate loss	-	45-70
	Severe loss	-	greater than 70.

4. Upper Arm circumference.
Measure the middle of the upper arm.
Mark off 10 cm., with coloured pen.
Do not forget to substract the 10 cm., from the final measurement.

5. Blood pressure.

5.1 Diastolic pressures is measured when the sound becomes muffled not when it stops. Record actual systolic and diastolic pressures.

5.2 Abnormal systolic-greater than 110 (95th percentile), abnormal diastolic greater than 70 (95th percentile).

6. Mild disability or defect refers to conditions in which there is no impairment of function.

Moderate disability or defect refers to conditions in which the degree of impairment of function partially handicaps the child's participation in the school programme.

Severe disability or defect refers to conditions in which the degree of impairment of function severely handicaps the child.

7. Speech defects.

7.1 In 14(a) Articulation - Absent should be mild and present should be significiant. If absent make no mark.

7.2 In 14(b) Comprehension - Moderate and Severe Defect become one category of significant.
Similarly 14(c) and 14(f).

7.3 Tests for assessing speech status are enclosed.

2. Health Commission of New South Wales
Western Metropolitan Health Region

SCREENING TEST OF SPEECH AND LANGUAGE FOR THE MOUNT DRUITT EARLY CHILDHOOD PROJECT (to be administered to 9 year old children - March, 1982.

NAME: ..... DATE: .....

SCHOOL: ..... EXAMINER: .....

14(a) ARTICULATION: "Count from zero to twenty slowly"

zero	seven	fourteen
one	eight	fifteen
two	nine	sixteen
three	ten	seventeen
four	eleven	eighteen
five	twelve	nineteen
six	thirteen	twenty

(Also Listen to the child talking and think about the child's sounds when saying the Expressive sentences.)

(Doctors asked to note any difficulty with r) = ABSENT

Scoring: only "THREE and THIRTEEN" incorrect = MILD PROBLEM

any other errors = SIGNIFICANT PROBLEM

14 (b) COMPREHENSION: "Here is a picture. I want you to listen to what I say. Then, I want you to do some things with the picture."

1. Touch all the things except the tree.
2. Show me the cat chased by the rabbit.
3. Where's the person who shows the boy the lady?
4. If there are no flowers in the picture turn the picture over.
5. What is neither an animal nor a person?
6. Show me the person who has a ball but isn't a boy.

5 or 6 correct	= Absent	TOTAL
4 correct	= Mild Problem	
3 or less correct	= Significant problem	

14(c) EXPRESSION: "Say these sentences after me"

1. We went to the pool even though Karen was sick.
2. Have the lollies been eaten by you?
3. We met a dog that was green, at the circus.
4. If you don't jump in the mud, I'll push you.
5. Although he saw a ghost he didn't run away.
6. I want a drink that isn't fizzy when I get home.
7. Tell me, why do you call a fire station when there's a fire?

Finish this sentence. You call .....

.....

Listen for (because, so, to, and)

TOTAL

6 or 7 correct = Absent

4 or 5 correct = Mild Problem

3 or less correct = Significant problem

BI-LINGUAL BACKGROUND "What language do your parents speak at home

Absent
Present

14 (d) ORO-MUSCULAR PROBLEMS Absent Present

14 (e) VOICE PROBLEMS (Note if voice is husky, throaty, nasal, hoarse or strained).

Absent Present

14 (f) FLUENCY PROBLEMS Absent

Rarely occuring = Mild

An aware child and/or a noticeable stutter. = Significant

14 (g) COMMUNICATION DISORDER

None Present .. .. ..

Under Treatment or Review .. .. ..

Treatment Completed .. .. ..

Requiring assessment/treatment .. .. ..

Detect Present but not amenable to treatment.

Screening Test compiled by:

Speech Therapists - Mt Druitt Polyclinic.

For information contact:

CAROL KNOX)
) Telephone No. 625 6000
KERRY SEAGER)

3. Stages of Development of Secondary Sex Characteristics

The standard Tanner ratings on a scale of 1 to 5 were used; both photographs and the written definitions below were used by the raters.

Stages of development of the secondary sex characters. (Taken by kind permission of the publishers from the standard illustrations in Growth at Adolescence 2nd ed., Oxford, Blackwell See. Publ., 1962; see also Chapter 7 in Textbook of Paediatrics ed. J. Forfar and G. Arneill, Churchill-Livingstone 1973).

Boys: genital (penis) development:

- Stage 1. Pre-adolescent, Testes, scrotum and penis are of about the same size and proportion as in early childhood.
- Stage 2. Enlargement of scrotum and testes. Skin of scrotum reddens and changes in texture. Little or no enlargement of penis at this stage.
- Stage 3. Enlargement of penis, which occurs at first mainly in length. Further growth of testes and scrotum.
- Stage 4. Increased size of penis with growth in breadth and development of glans. Testes and scrotum larger; scrotal skin darkened.
- Stage 5. Genitalia adult in size and shape.

Girls: breast development:

- Stage 1. Pre-adolescent: elevation of papilla only.
- Stage 2. Breast bud stage: elevation of breast and papilla as small mound. Enlargement of areola diameter.
- Stage 3. Further enlargement and elevation of breast and areola, with no separation of their contours.
- Stage 4. Projection of areola and papilla to form a secondary mound above the level of the breast.
- Stage 5. Mature stage: projection of papilla only, due to recession of the areola to the general contour of the breast.

Both sexes: pubic hair:

- Stage 1. Pre-adolescent. The vellus over the pubes is not further developed than that over the abdominal wall, ie. no pubic hair.
- Stage 2. Sparse growth of long, slightly pigmented downy hair, straight or slightly curled, chiefly at the base of the penis or along labia.
- Stage 3. Considerably darker, coarser and more curled. The hair spreads sparsely over the junction of the pubes.
- Stage 4. Hair now adult in type, but area covered is still considerably smaller than in the adult. No spread to the medial surface of thighs.
- Stage 5. Adult in quantity and type with distribution of the horizontal (or classically 'feminine') pattern. Spread to medial surface of thighs but not up linea alba or elsewhere above the base of the inverse triangle (spread up linea alba occurs late and is rated stage 6).

Appendix C

Mt Druitt - Speech Therapy Data

Wes Baker
Western Metropolitan Regional Office
N.S.W. Health Department

MOUNT DRUITT - SPEECH THERAPY DATA

Wes Baker
Regional Office

1. Means

Only the comprehension and expression variables lend themselves to a mean and standard deviation calculation.

The mean score for comprehension is 5.09, the standard deviation is 0.98.

The mean score for expression is 5.71 with a standard deviation of 1.45.

The attached tables show the numbers falling into the significant, mild and absent categories as defined by your attachment.

If, as a general principle, a "significant" score should be below 2 standard deviations from the mean than a score on "comprehension" of 3 or below for a "significant" score is acceptable.

The level of significance on the expression variable would seem, on the basis of the above criteria, a little high. Two standard deviations below the mean gives a score of 2.8. Therefore, a cut-off point for the expression score would seem to be 3 rather than 4 with scores of four and five as mild. Inspection of the data shows a rapid fall-off between 6 and 4 with from 3 to 0 as a fairly stable "tail".

2. Number of Significant Problems

The table below shows the number of children by the number of problems reported for the child. It is based on the amended significance score for expression.

Number of Problems for any Individual

Number of Problems reported on any Child	Number of Children with that number of Problems	
	Significant	Mild
1	104	211
2	33	67
3	10	5
4	1	0
Total Children with a Problem	148	283

The doctors reported 216 (34.62%) requiring assessment. Using no lower criteria an expression of 3, only 148 children needed assessment (23.72%). On the higher criterion of 4, 184 needed assessment (29.49%).

3. Bilingual

The tables below show results for the children who reported parental use of languages other than English.

3.1 Articulation Score - Bilingual

Result	No. Children	%
Absent	46	68.66
Mild	13	19.40
Significant	6	8.96
Total	65	100.00
No data	2	2.99

3.2 Comprehension - Bilingual

Result	No. Children	%
Significant	10	16.42
Mild	9	13.43
Absent	47	70.15
No Data	1	1.49
Total	67	100.00

3.3 Expression - Bilingual

Result	No. Children	%
Significant	11	16.42
Mild	19	28.36
Absent	37	55.22
Total	67	100.00

4. Differences between the Doctors

The tables below show the results reported by the four doctors on the variable articulation, comprehension and expression.

4.1 Measures of Articulation by Doctor

	Doctor				
	1	2	3	4	Total
Absent	76	101	109	191	477
Mild	20	18	42	26	106
Significant	11	15	7	5	38
Total	107	134	158	222	621

$X^2 = 32.36$ on 6 degrees of freedom.

The above table shows a significant difference between doctors in the rate of reporting articulation problems.

4.2 Measures of Comprehension by Doctor

	Doctor				
	1	2	3	4	Total
Significant	16	0	20	9	45
Mild	24	5	33	42	104
Absent	67	129	107	171	474
Total	107	134	160	222	623

$X^2 = 57.0574$ on 6 degrees of freedom.

There was a significant difference between the doctors in the reporting of comprehension problems.

4.3 Measures of Expression by Doctor

	Doctor				
	1	2	3	4	Total
Significant	9	4	24	22	59
Mild	27	20	46	53	146
Absent	70	111	86	144	411
Total	106	135	156	219	616

$X^2 = 26.7472$ on 6 degrees of freedom.

There was a significant difference between doctors in the reporting of expression problems.

4.4 Oro-muscular by Doctor

	Doctor				
	1	2	3	4	Total
Absent	101	92	152	220	565
Present	2	12	2	1	17
Total	103	104	154	221	582

$X^2 = 33.7626$ on 3 degrees of freedom.

The expected values lin the "present" cells fall too low to be confident in the result of X^2. Inspection shows visual differences.

4.5 Measures of Voice disturbance by Doctor

	Doctor				
	1	2	3	4	Total
Absent	92	125	150	216	583
Present	13	8	6	2	29
Total	105	133	156	218	612

X^2 = 21.3925 on 3 degrees of freedom.

There were significant differences between doctors in the reporting of voice disturbance problems.

4.6 Measures of Fluency by Doctor

	Doctor				
	1	2	3	4	Total
Absent	105	133	145	221	604
Present	2	2	10	1	15
Total	107	135	155	222	619

X^2 = 14.9369 on 3 degrees of freedom.

The expected values in the "present" cells fall too low to be confident in the result of X^2. Inspection of the data again shows difference.

4.7 Comments on Inter-Doctor differences

The comparison of doctors presumes that each doctor is a standard measuring instrument measuring a homogeneous population.

If one may assume for the present that the population is homogeneous, doctors 1 and 2 over reported articulation problems while doctor 4 under reported them.

Doctors 1 and 3 over reported comprehension problems while doctors 2 and 4 under reported them.

Doctor 2 under reported expression problems while doctor 3 over reported them.

The numbers in the "present" cells are too small in the Oro-muscular, voice disturbance and fluency variables, but visually similar inconsistencies appear to conintue in these variables.

The section which follows, which attempts to show the difference between schools will show to what extent the population is homogeneous.

5. Difference between Schools

While it is possible to show inter school differences, the fact, that generally each school was screened by a single doctor, means that the inter school differences cannot readily be distinguished from inter doctor differences.

Articulation	School					
	1	2	3	4	5	6
Absent	183	75	68	34	36	81
Mild	26	20	5	13	12	30
Significant	9	11	7	8	2	1
Total	218	106	81	55	40	114

Comprehension	School					
	1	2	3	4	5	6
Significant	16	15	0	0	5	9
Mild	23	47	4	2	6	22
Absent	77	156	76	53	39	34
Total	116	218	80	55	50	65

Expression	School					
	1	2	3	4	5	6
Significant	8	30	1	4	3	13
Mild	28	62	7	13	15	25
Absent	70	126	73	38	32	75
Total	106	218	81	55	50	113

Articulation	Males	Females
Absent	225	254
Mild	79	28
Significant	26	12
Total	330	294

Comprehension	Males	Females
Significant	29	17
Mild	70	34
Absent	232	244
Total	331	295

Expression	Males	Females
Significant	40	20
Mild	86	64
Absent	203	210
Total	329	294

Appendix D

Macquarie University - Mt Druitt Longitudinal Study

Paper presented at a Staff Conference, Westmead Centre by
Dr E. Haskard
Dr B. Belfer
Dr K. Rosley

January 1982

As this was a continuation of a study started a few years ago, we felt you would be interested in some background information.

In 1975 Macquarie University School of Education set up the Mt Druitt Early Childhood Project in conjunction with the Education Department. This project was funded by the Bernard van Leer Foundation whose headquarters are at The Hague in the Netherlands.

This was partly a Research Project to develop, implement and evaluate five different types of pre-school programs in early childhood education, and hopefully to continue these programs into at least the first two years of schooling, i.e. Kindergarten class and Year One.

Apart from the Education aspect of this study, the Health Commission was involved in setting up a Medical component to the project.

The years 1975 and 1976 were used to investigate the best ways of setting up a program of this nature, the start of the actual three years Project was in 1977. At this time it was thought that funding would only be available for these years, i.e. up to the end of 1979.

As most of us are working in the field of Child Health and know that school and education play such a great part in the lives of children (of school age and pre-school age) I thought a few words on the educational aspect of this original project would be of interest.

The main objectives included:

i) the determination of conditions under which particular programs are most effective.
ii) the refinement of programs to meet Australian educational practices,
iii) the involvement of parents and the community in the education process, and,
iv) to support parents in the task of child rearing.

Programs to be developed or modified represent a wide spectrum of educational beliefs ranging from the structured approach of the behaviourist school to the more traditional approaches based on aspects of psycho-socialisation theories.

Four school based and one home-based programs were set up and a total of 500 preschool children were divided between these areas. Their age ranged between 3-9 and 4-9.

These programs may broadly be distinguished as being based on:

1. Theories of behaviour modification at Whalan Avenue Preschool.

   This uses social praise as reinforcers, and is characterised by a philosophy that emphasises observable behaviour whilst playing down the thoughts, feelings and motives of the children. Objectives are thus very specific and aim at something that can be measured, so that the curriculum is tightly structured and the teacher has the task of assessing where a child is positioned on the developmental scale. Each step is taken at a pace which that particular child can manage and is mastered before progressing to the next level.

2. Theories of cognitive development at Dawson Preschool.

This is a school-like program with the concept that child development comes from the acquisition of knowledge. The program represents an educational strategy derived from Piaget's cognitive developmental theory which has implications for studying the processes involved in children's learning and for developing techniques for supporting cognitive growth. The techniques have been formulated into a curriculum which guides planning through the -

a) determination of goals
b) selection and sequencing of activities
c) assessment of cognitive levels
d) teaching of strategies
e) classroom procedures.

Cognitism is the action or faculty of knowing, perceiving, conceiving as opposed to emotion and volition, a perception, sensation, notion or intuition, (or) conscious faculty or process of knowing, of becoming or being aware of thoughts or perceptions including understanding and reasoning.

3. Theories related to teacher/child interaction at Madang Avenue Pre-school

A competency based programme of integrated day approach of a more permissive type.

This programme has developed out of the area of early childhood education which has attempted to specify which elements of education are essential for a child to be successful at school. It is based on child development theories which suggest that certain abilities and attitudes are essential for children if they are to be socially competent in a future school setting, thus both the children's cognitive development and their attitudes towards the process of schooling are important. As it is believed that the child's development in these 2 areas is affected by their feelings of self esteem, the growth of a positive self concept is emphasised.

The teachers and aides support and interact with the children continually during the sessions, helping and guiding where necessary. They plan for their lessons on a daily and longer term basis with all contributing to the planning task. As the focus is on working with individual children, the task of the teacher is to assess the child's present level of understanding or performance and provide matching and extending activities. The child thus works through the easier activities which are first presented to him and then works through the more complex and sometimes more abstract tasks.

If group activity is planned, lessons are given to children functioning at similar levels of development for a particular task. Even in these situations whenever practical, instructions are individualised.

4. Theories of social interaction.

This is based on the contemporary Australian Programme at Mount Druitt Public School, which believes that the long-term gains which are achieved by children through the development of a healthy self-concept, outweigh the immediate gains in achievement that may result from an academically oriented curriculum. The emphasis then is on developing children's abilities to use particular skills to learn such as making decisions, using resources, evaluating themselves and becoming more self-reliant, also in helping develop the child's ability to interact with adults, other children and materials. It is felt that these skills will in turn help the children to deal with academic challenges which will in time be presented to them. The security and confidence that the child acquires through acceptance by teachers and peers is the necessary foundation for successful learning.

Child/child interaction is thus seen both as a successful outcome of teaching style and as a means by which children develop self-esteem through the positive reaction of others to their efforts at interaction.

5. The home based intervention programme based at Bidwill.

Various programmes have been developed to cater for the concept of a non-sessional home-based preschool as a form of compensatory intervention. One of the best known was the T.V. programme - Sesame Street. Some have endeavoured to improve living standards and remove some envionmental restraints on children to help their learning processes, others by the provision of materials, or teaching or both have focused on basic skills relating to pre-reading, pre-number and language.

At this time 1975/76 there was no other existing preschool in Bidwill and although at a parents' meeting a preference had been expressed for a sessional preschool, the parents present all expressed interest in the project and their children were enrolled. The teachers involved in this programme did not give direct help but were able to assess any impairment to the child's physical, social and intellectual development and to focus their assistance in these areas. Parental involvement and often change of attitude etc, were often the focus of intervention.

The medical aspects associated with the Project were directed towards 2 areas.

1. providing medical advisory care to children and parents who had been referred by teachers, and
2. piloting parameters to be used in the medical component of the project.

In this first area any child who had been observed by teachers as exhibiting behaviour which warranted further investigations were referred to the Child Health section at the Polyclinic. Others problems were discussed and the children were seen during our visits to the preschools and follow-up arranged if and as necessary with parents.

> The Project organisors felt that in many ways the Polyclinic staff provided services as health educators for talks, discussions, etc, held during parents and teachers meetings etc.

These 2 aspects of a) educating the parents about more acceptable ways of providing appropriate health care for their children, and b) of having available referral services proved to have been invaluable to all concerned with the project as it has yet again shown how the schools can cooperate with the health professionals in providing worthwhile care for children.

Basically the second area concered the development and trial of appropriate procedures for the medical survey of the children in the Project. The objectives were:

(a) to gather developmental information about the children in the sample. This can be of historical and/or diagnostic value, and
(b) to design a nutritional survey which can provide valuable information about the nutritional habits of the families in the area.

For the developmental profile a form was tried, this covered aspects of the child's pre, peri and post natal development, height and weight status and other general information was gained.

This was obtained by interviewing each mother and/or father and from physical examination of the child. In addition we trialled a modified version of the Denver developmental test. This test was chosen as it represents a quick checklist of the

child's development against a set of U.S. norms and thus might have enabled cross-cultural comparisons to be made. However, it was felt that the information gained from its use did not warrant its continued use despite the fact that there is no alternative.

The nutritional survey has as its objectives:

1. investigate and assess the nutritional status of each child in the sample;
2. identify high-risk groups and begin to identify causative factors;
3. provide baseline data for developing and evaluating a nutritional programme for pre-school children; and
4. establish viable procedures for assessing the nutritional status of at risk children.

The survey it was hoped would include the gathering of food consumption data from the parents, bio-chemical analysis of the child's current health status (by blood etc, examination) and the extrapolation of the nutritive values of the consumed food. All this information would be correlated with the existing medical information about each child.

It was then intended to correlate all the information obtained in all areas with the children's present and future academic school progress throughout their school career.

The main study was in 1977 and we collected all the data and medically examined 120 children, again between the ages of 3-9 and 4-9. The 120 children were randomly selected by the project staff, 20 from each preschool and 20 supposedly a control group.

The data regarding the children's medical history was cross-validated through the examination of hospital records relating to the birth of the child and any further admissions if they were relevant.

Again this data was to be used to correlate specific information with observed school performance as the children passed through the higher grades.

For our part all defects found were discussed with the parents and a teacher if appropriate and followed up the following year when the child was in the kindergarten class of the Infants School.

Unfortunately the Nutritional Survey which was to have been completed also in 1977 had to be postponed partly because of the difficulties involved in organising such a survey with Health Commission staff.

However, in 1978 a programme was set up by the Human Nutrition Unit of the Commonwealth Institute of Health, University of Sydney. This was also partly funded by the Van Leer Founation. This study was not as detailed as was first envisaged, partly because detailed blood chemistry of the children concerned was not obtained. The method used was to study (a) the children's total food intake over a period of two days and (b) the children's regular eating habits. It was therefore principally a dietary survey.

Only 86 of our original 120 children were assessed. The reason being that 31 families had moved out of the area and 3 mothers refused to be interviewed.

Information was obtained by interviewing the mothers, using a 24 hours dietary re-call, check questions, questions on food habits and a 2 day food record. The children concerned who were then in Kindergarten at school and aged 5 years 7 months + 3/12 were also interviewed.

Food intake was coded on a standard form, and nutrient intakes calculated using a computer programme developed from - (a) Tables of Composition of Australian Foods, and (b) Manufacturers Information.

This study demonstrated that as a group these children had an adequate dietary intake. However, individual data showed that in 1/3 of the children the dietary intake failed to meet the Recommended Daily Allowance for at least one nutrient (14 nutrients were assessed). This R.D.A. level was that advised by the National Health and Research Council in 1971. An intake below the level recommended does not of necessesity imply deficiency, but naturally the further below this level the greater the probability that an individual's intake is less than the requirement. Also of importance is the fact that it is not possible to compare these findings with other sections of the Australian community because of a lack of available information for comparison.

Although the original sample of 120 children was random the children taking part in the dietary study were volunteers by virtue of the fact that their mothers had agreed to take part. It has been found that those who do not take part are often those who may be at most risk.

Whilst in this study adequency of diet was mainly being checked, there is a possibility that a problem could be in the other direction, eg. that the diet is over-adequate in energy intake. This was supported by the fact that 13% of the children were over the 90th percentile for weight.

Individual reports, adequately detailed and making sensible recommendations regarding children's diets and eating habits, were sent to the parents of the children studied.

Following this study in 1978 we were not actively involved in the Project and thought that although on-going educational assessments were made that no further input of medical data would be envisaged.

In 1981 the Health Commission was again approached to collect data on the physical development and health of all fourth grade children in the 5 Mount Druitt Schools involved in the original project and also at Leonay School at Emu Plains. It was hoped to evaluate relationships between health measures and school performances and progress for a large number of children receiving normal education.

The concepts for this Longitudinal Study grew out of the earlier project but its methods, aims and objectives are quite different. In essence the current study is a seemingly experimental research project whereas the earlier project was an action programme (with some elements of a research character) in early childhood education.

One of this project's aims was to develop a data bank about the health, social, psychological and educational development of children.

One of the hypotheses underlining the original Mt Druitt Early Childhood Project was that early intervention with disadvantaged children would assist them to take greater advantage of their later, regular school experiences and this has had some support but as with all the on-going evaluation and assessments no conclusive results can be arrived at until the end of the child's schooling.

So also with results of our survey, the project pesonnel were still assessing the children at the end of the year and although some initial trends had been promised us for early this year. The staff at Macquarie are still on vacation and I have been unable to contact them.

A couple of interesting comments were made however when I saw the projects director just before Christmas. One was to the effect that our results in the Speech and Language assessment did seem to correlate with school performance and also that tall children do better at maths.

From our point of view I think we felt it was a worthwhile exercise and if I could just mention what has happened to a few of the children in whom we found physical defects.

One girl, with scoliosis was in a brace within a few weeks of our original notification and has by now probably had an operation as the last I heard was that she was waiting for a hospital bed.

Another child with an inguinal hernia, I saw again a couple of months later having had a repair.

A boy with undescended testes had had an operation, and another boy had a few exostoses (osteochondromatusis) removed and was feeling very happy without his 'lumps'.

The correlation between physical growth and learning ability will I expect have to await for Macquarie University's computers to start working on the available data again.

Results of 1982 Survey

Starting on 1st March 1982, a survey was done by Community Nurses and Medical officers of 621 school children in the Mt Druitt - Emu Plains area of N.S.W. This survey was performed in co-ordination with staff of the School of Education, Macquarie University. The children involved were in 4th class and aged 9-10 years, of these, 50.7% were boys and 49.3% girls.

The parameters screened were 16 in number, including V.A., hearing, B.P., orthopaedic and congenital defects, speech defects, and sexual development.

An attempt was made to correlate physical development and health, with school performance and progress (as assessed by Macquarie University staff).

Some details, based on computer figures provided by Macquarie University are -

Table 1

Visual Acuity	Findings	R	L
	6/6	92.6%	91.8%
	6/9	4.3%	5.0%
	6/12	1.6%	1.6%
	6/18	0.8%	0.8%
	6/24	0.2%	0.2%
	6/36	0.3%	-
	6/60	-	0.5%

Unfortunately, a computer printout of the % of children with a vision defect, irrespective of laterality, was not attainable. Visual acuity was assessed by community nurses, using the Sheridan-Gardner method.

Out of a total number of 621 children:

3.5%	(22)	were corrected (ie. had glasses)
0.3%	(2)	were unable to be corrected
1.1%	(7)	were uncorrected (ie. notified).

Hearing - this was screened using an audiotester first up, with follow-up by standard audiometry of dubious cases.

Table 2

Hearing Loss	Low frequency	
	R	L
25d B = 'No' loss	95.0%	94.4%
25-45d B = Mild	3.1%	3.9%
45-70d B = Moderate	1.3%	1.0%
70d B = Severe	0.5%	0.6%

1 person absent.

Hearing Loss	High frequency	
	R	L
25d B = 'No' loss	96.5%	96.0%
25-45d B = Mild	1.8%	2.1%
45-70d B = Moderate	1.1%	1.1%
70d B = Severe	0.3%	0.6%
	2 absent	1 absent

Ear Infection (examination by the nursing staff).

These were coded evident/not evident by inspection with an auroscope ie. external canal inflammation.

Evident	4.7%
Not evident	95.0%
Absent -	2 children

B.P. (normal regarded as 110/70mm).
540 out of 621 participated.

Normal	82.8%
Above	3.5%

A further analysis revealed the following:

Systolic B.P. - (Total Sample n = 540)

	Mean	Range	Min	Max	S.D.
Leonay Sample (n = 40)	94.4mm	59mm	66mm	125mm	9.7mm
Mt Druitt Sample (n = 500)	94.6mm	59mm	66mm	125mm	9.8mm

Diastolic B.P.

	Mean	Range	Min	Max	S.D.
Leonay Sample (n = 40)	60mm	55mm	30mm	85mm	8.0mm
Mt Druitt Sample (n = 500)	60mm	55mm	30mm	85mm	8.0mm

Orthopaedic

'Mild' = no impairment of function	Nil	89.4%
'Moderate' = a degree of impairment Sufficient to partially handicap child's participation in school programme.	Mild	8.5%
	Mod.	0.3%
'Severe' = the impairment severely handicaps the child.	Severe	0.2%

Cerebral Palsy 0.3%

The subject of speech and language defects will be covered by Dr Kathy Rosley. Kerry Seager, speech pathologist at Mt Druitt Polyclinic designed the questionnaire, assessed the findings and is carrying out the follow-up.

Sexual Development

This is classified according to Tanner's 5 point scale, such that "1" would be pre-adolescent and "5" would be adult development.

Male genitalia	1 -	41.2%
	2 -	7.6%
	3 -	1.1%
Male pubic hair	1 -	49.1%
	2 -	0.8%
Female breast development	1 -	27.4%
	2 -	9.3%
	3 -	1.4%
	4 -	0.2%
Female pubic hair	1 -	45.1%
	2 -	3.2%
	3 -	0.2%

Menarche	Occurred	- 0.2%
	Not yet	- 44.9%

I am indebted to Dr Kathy Rosely for preparation of transparencies, and she will now discuss the findings of speech and language assessment (see Appendix B).

Appendix E

Multivariate Regression Analysis

Table 1: Canonical Variables of the Dependent Variables
Mt Druitt Sample (n = 186)

Correlations with Dependent Variables (D.V.'s) / % Variances Explained	Canonical Variables 1	2
Correlation with D.V.'s:		
Maths achievement	+0.32	+0.88
Word Knowledge	+0.33	+0.78
IQ	-0.40	+0.90
% explained variance of:		
Dependent variables	12.30	85.00
Independent variables	1.58	5.85

Table 2: Canonical Variables of the Independent Variables
Mt Druitt Sample (n = 186)

Correlations with Independent Variables (I.D.V.'s) / % Variances Explained	Canonical Variables 1	2
Correlations with I.D.V.'s:		
Height	+0.28	+0.89
Age	+0.97	-0.05
Father's education	+0.09	-0.52
Height X Age	+0.70	+0.69
Height X Father's education	+0.16	-0.32
% explained variance of:		
Independent Variables	30.78	32.73
Dependent Variables	3.95	2.63

Table 3: Significant Canonical Correlations
Mt Druitt Sample (n = 186)

ROOT NUMBER	EIGENVALUE	PCT	CANONICAL CORRELATION	SQUARED CORRELATION
1	0.14702	59.76	0.36	0.13
2	0.08750	35.57	0.28	0.08

Table 4: Canonical Variables of the Dependent Variables
Group includes Mt Druitt Schools and Contrast School 1 (n = 228)

Correlations with Dependent Variables (D.V.'s) / % Variances Explained	Canonical Variables 1	2
Correlation with D.V.'s:		
Maths achievement	0.71	-0.63
Word Knowledge	0.69	-0.53
IQ	0.99	-0.03
% explained variance of:		
Dependent variables	65.69	22.56
Independent variables	15.66	2.13

Table 5: Canonical Variables of the Independent Variables
Group includes Mt Druitt Schools and Contrast School 1 (n =228)

Correlations with Independent Variables (I.D.V.'s) / % Variances Explained	Canonical Variables 1	2
Correlations with I.D.V.'s:		
Height	-0.51	+0.64
Age	+0.46	+0.83
Father's education	+0.79	-0.21
Height X Age	-0.17	+0.92
Height X Father's education	+0.71	-0.09
% explained variance of:		
Independent Variables	32.57	39.73
Dependent Variables	7.76	3.75

Table 6: Significant Canonical Correlations
Mt Druitt and Contrast School 1 (n = 228)

ROOT NUMBER	EIGENVALUE	PCT	CANONICAL CORRELATION	SQUARED CORRELATION
1	0.31296	74.18	0.49	0.24
2	0.10413	24.68	0.31	0.09